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CGIAR PROGRAMME ON PLANT GENETIC RESOURCES: SOME SYSTEM-WIDE ISSUES

(Agenda Item 9)

For Discussion

The Third External Review of IBPGR (1991) drew attention to several System-wide issues that were considered important for shaping future CGIAR programme on plant genetic resources. As the issues concern Centre Directors and Centre Boards, TAC requested that a background paper be prepared as a basis for discussion in the joint session with Centre Directors and Centre Board Chairs during TAC 56.

TAC SECRETARIAT

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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TABLE OF CONTENTS

SUMMARY

The Third External Review of IBPGR (1991) drew attention to several System-wide issues that were considered important for shaping future CGIAR programme on plant genetic resources. These issues related to: CGIAR perspectives towards a global strategy for the conservation of plant genetic resources; inter-Centre collaboration; relationships between the CGIAR and other international efforts in conservation of biodiversity; and the question of ownership and security of the CGIAR funded genebanks. There are several elements of these issues on which the CGIAR must position itself to provide intellectual leadership.

There is a need to recognize the importance of regarding work on plant genetic resources as an integral part of research on crop improvement, and that the CGIAR, in the further development of its strategy, should ensure that activities associated with the conservation of plant genetic resources are more closely integrated into national and international breeding programmes. TAC believes that this would help to improve the cost-effectiveness and long-term viability of national and regional programmes in plant genetic resources. In this regard, criteria and techniques are urgently needed for the selection of genetic material to be conserved.

The CGIAR System should widen the scope of its scientific and technical support for the conservation of genetic resources by using the capability of all its institutions with relavant mandates to assist in solving problems that are common to a range of species. However, inter-Centre collaboration on research and other aspects of plant genetic resources should be planned and undertaken within the framework of a System-wide programme strategy.

Concern about the conservation of biodiversity is now widespread and involves a wide variety of technical, social and political organizations. The potential exists for new sources of support for the work of the CGIAR Centres.

The legal status of CGIAR genebanks differs considerably among Centres, depending on their agreements with the host governments. There is a need to ensure that such agreements are consistent with CGIAR policy, and that step are taken to duplicate the germplasm held in trust by CGIAR Centres.

1. Introduction

1.1. Background

The Second External Review of IBPGR (TAC/CGIAR 1985) provided an analysis of the work on genetic resources by the Commodity Centres. It examined the ways in which these Centres had successfully linked conservation and utilization through plant breeding programmes. The Review Panel concluded that the recognition of the importance of the work on genetic resources as an integral part of crop improvement was a major contribution of the Commodity Centres.

While recognizing ways in which IBPGR and the Commodity Centres had worked closely together, the 1985 Review noted some areas where clarification of their respective roles was needed and made recommendations accordingly. In its commentary on the IBPGR Review, TAC endorsed the Panel's opinions, but concluded that IBPGR's relations with the CGIAR Commodity Centres should be more explicitly addressed in future external reviews.

At its meeting in October 1988, the CGIAR adopted a policy statement on plant genetic resources prepared by TAC (IBPGR 1989). The statement reaffirmed that the purpose of the CGIAR support for the work on plant genetic resources was "to ensure that the diversity of germplasm is safely maintained and made available for use in programmes of research and crop improvement for the long-term benefit of all people. The CGIAR seeks to achieve this purpose both directly, through the institutions it supports, and indirectly, through strengthening national capabilities".

The purpose of the policy statement was to define the CGIAR position on a topic of interest and importance to a wide audience, and to draw attention to some of the issues connected with the continued preservation of genetic diversity for food crops. Many of these issues were identified in the papers presented to TAC and discussed jointly with the Board Chairs and Centre Directors prior to the adoption of the policy statement (TAC 1987a and 1987b, CD 1987). As a result of these discussions, and the CGIAR policy statement, three ad hoc groups were formed to continue the work on related issues.

First, an Inter-Centre Working Group on Plant Genetic Resources, reporting to Centre Directors, was established to concentrate on the technical and operational issues. Second, a Joint TAC-Centre Directors Committee on Plant Genetic Resources was constituted to monitor implementation of the CGIAR policy, to discuss the more general issues with policy implications and to resolve problems by reference to the Centre Directors, the Centre Boards or TAC, as appropriate. Third, a task force (BIOTASK), composed of donor, TAC and Centre representatives, was convened to follow the broader political and legal issues connected with biotechnology and to bring these to the attention of TAC and the CGIAR.

At its meeting in June 1991, TAC requested that a background paper be prepared on the major System-wide issues (other than those related to property rights) that were considered important for shaping future CGIAR programme on plant genetic resources, as a basis for discussion with Centre Directors and Centre Board Chairs at the October 1991 TAC meeting in Washington. This paper is a response to that request. With regards to the implications of property rights, the topic is being considered by an ad hoc committee of Centre Directors, as well as by BIOTASK and by the Joint TAC-

CD Committee on Plant Genetic Resources. A separate paper prepared by the ad hoc committee of Centre Directors is also due for discussion with TAC and Centre Directors in October 1991 (TAC 1991).

1.2. System-wide Issues

The Third IBPGR External Review (TAC/CGIAR 1991) made the following recommendations:

(1) "Taking note of the changing role of the Commodity Centres, their close linkage with national programmes, and the potential to use their capabilities in a concerted attack on key problems related to the conservation of plant genetic resources, the Panel recommends that:

(i) the CGIAR should widen the scope of its scientific and technical support for the conservation of genetic resources by using the research capability of all the institutions with relevant mandates to assist in solving problems that are 'common denominators' to a range of species; and

(ii) such research should be planned and undertaken within the framework of a programme agreed across the whole CGIAR System" (Recommendation 6.2).

(2) "The Panel recommends that TAC should consider including the conservation of genetic resources in its analysis of strategies for conducting research on problems of wide importance across the CGIAR System" (Recommendation 11.1).

The Review drew attention to several System-wide issues that were considered important for shaping future programme on plant genetic resources. These included the following:

(i) What should be the CGIAR policy perspectives towards a global strategy for the conservation of plant genetic resources?

(ii) What should be the Centres' policy on inter-Centre collaboration on research and related activities to solve problems that are common to a range of species?

(iii) How should the CGIAR's efforts in plant genetic resources relate to other international efforts in the conservation of biodiversity?

(iv) What should be the Centres' policy on ownership and security of the CGIAR funded genebanks?

The above issues were highlighted against the background of the second generation of challenges that have now arisen. Foremost among these are the inability of national programmes to mobilize the finanancial resources needed to maintain or exploit the collections they already have, let alone to increase their size and coverage, or to evaluate the accessions they contain. The other problems have arisen from evolving political awareness of the implications of property rights on the products derived from plant germplasm, giving rise to questions of ownership and free exchange, and to the desire for acceptance of the principle of

"farmers' rights". One consequence has been the desire of individual national programmes to build and maintain their own genebanks, instead of relying on regional or international ones.

The above challenges prompted the Review Panel to raise the following questions: Can the world community afford to pay for the repetition of effort implicit in the proliferation of national genebanks? Is it realistic to think that national programmes will give this work the priority it requires? Is there a politically acceptable alternative, and what should be the role of the CGIAR?

The Review Report was discussed by TAC in March 1991, and by the CGIAR in May 1991. The Panel recommendations and the TAC Commentary were endorsed by the CGIAR. In its Commentary TAC noted the comments made by the Panel on the System-wide issues, and agreed with the Panel that their resolution would facilitate the further development of the respective roles of IBPGR and the Commodity Centres. TAC also concurred with the Panel that for the CGIAR System to play an effective leadership role in the conservation of plant genetic resources, the strategies (and perhaps the mandates) of the individual Centre programmes may have to be reexamined, and there would have to be a strong integrating mechanism for collective action that could stimulate research and conservation activities in national programmes and in the work of other institutions. The System-wide issues listed above are considered in turn in the following sections.

2. Towards a Global Strategy for the Conservation of Plant Genetic Resources

In its vision of the future for the CGIAR (TAC 1990), TAC concluded that a continuing principal responsibility for the CGIAR should be in the germplasm area. Collection, conservation, characterization, evaluation, and basic germplasm enhancement activities for plants and animals that have transnational and/or global utilization would continue to require an international and apolitical effort. This must include the preservation of biodiversity. The research related to these activities would most likely be strategic and involve applications of modern molecular biology as well as more traditional scientific techniques.

Long-term CGIAR support for these activities could take several forms. One would be to narrow the focus of existing Commodity Centres to germplasm activities and strategic research. There could be consolidation across commodities to capture more economies of scale. A second approach would be a decentralized mechanism where nodes of basic germplasm work were fostered in a networking mode appropriately located, for example, at or near the centres of origin or other centres of diversity. A third approach would be a continuation and expansion of the IBPGR model, as was, perhaps, implicit in the CGIAR's decision to establish the International Plant Genetic Resources Institue (IPGRI) as an independent institution. Whatever the form, the activities should be highly focussed, strategic and provide basic inputs into national programmes.

If the CGIAR programme on plant genetic resources is to evolve as a coherent and cost-effective effort, it is necessary to identify and agree on those policy and strategic perspectives that would foster such an evolution. These relate to the purpose, efficiency and scale of

conservation; alternatives to conventional (ex situ) genebanks; and the role of CGIAR towards a global strategy.

2.1. The Purpose of Conservation

Conservation of germplasm has two related aims: preservation for future use; and access for current use. The first implies conserving that germplasm which is under threat of extinction; the second implies conserving that which is potentially useful. Which of these purposes should predominate?

The conservation of all germplasm that is potentially valuable for crop improvement, would make reasonable sense provided that some rational limit can be placed on the total. Moreover, conservation could not be sustained as an isolated activity or discipline. Conservation is a sustainable activity only as means of exploiting genetic variation for improved human well-being both now and in the long-term future. Consequently, easy access to well-preserved and well-documented germplasm, by plant breeders, biotechnologists and other scientists, is an essential prerequisite.

There is broad consensus in TAC that IBPGR, in the future development of its strategy, should place increased emphasis on making genetic resources more easily accessible to plant breeders and other scientists. It should also ensure that activities associated with the conservation of plant genetic resources are more closely integrated into national and international breeding programmes. TAC believes that this would help to improve the long-term viability of national and regional programmes in plant genetic resources.

2.2. The Efficiency and Scale of Conservation

If national and international resources are to be used in a cost-effective manner, there must be a clear consensus on the criteria that can be used to limit the scale on which conservation is required. Is it essential, for example, to preserve indefinitely into the future over 100,000 accessions of a single crop? Are there less costly, but acceptable alternatives?

Criteria and techniques are urgently needed for deciding on the appropriate scale of conservation of genetic resources. In their absence, the only defendable policy has been to "play safe" and save everything. There is also a very conservative approach among many curators to the principles of amalgamating or merging accessions to reduce the total number that have to be individually stored and documented. In future, however, such attitudes might not be acceptable, as funding for the replication of effort implicit in attempting to preserve all accessions for all times may become increasingly hard to find. Criteria based on scientific and statistical principles are urgently needed, therefore, to define acceptable limits to collections. It is especially in this area that more research is urgently required.

The ultimate success of base and active germplasm collections will be dependent on the validation of the criteria on which they are based. It

seems likely that such validation will be greatly facilitated by the use of techniques from molecular biology, a discipline that will increasingly influence attitudes on the necessary scale and content of germplasm collections. Only when there is confidence in the criteria, however, will curators be prepared to concentrate on concepts such as optimum collections and core collections and, consequently, be in a position to better manage the extent of existing base collections.

If these issues are difficult to resolve for normal seed plants, they are even more difficult to resolve for plants with recalcitrant seeds and for clonal crops. All of these considerations highlight the urgent need for research to produce criteria for the more rational determination of the composition of long-term collections and the scale on which conservation is required.

2.3. Alternatives to Conventional Genebanks

There is considerable interest among individuals and institutions in the developing countries in the possibilities of involving small-holders, horticulturalist, estate-owners, and private-sector organizations more actively in germplasm conservation. This is an area of activity that could be fostered, and IBPGR could provide leadership.

Initiatives of this type fall broadly into the catagory of "field" genebanks. More comprehensive field genebanks may feature in work supported by public-sector institutions in the form of collections of perennial species and clonal crops, as well as wild species in botanic gardens. For wild species, increasing efforts are being made to designate protected areas for *in situ* conservation. All of these methods for conservation present potentially valuable complementary options for developing countries, not only of maintaining valuable material, but also of keeping it under constant observation. However, all these methods need further evaluation to assess the possibilities of building a sustainable strategy around them.

Conservation of wild species that are potentially important for crop improvement is one aspect of the more general concern for protecting "biodiversity". Other international organizations, such as FAO, Unesco, UNEP, IUCN, WRI and WWF, are working on issues related to biodiversity and conservation, more generally. It is considered that the CGIAR could not afford to be only a spectator in this process, as it could make valuable contributions to the evolving consensus.

Then there are questions of exploiting more fully opportunities for the long-term storage of germplasm under natural conditions, such as in the Arctic or Antarctic, or at high altitudes in mountainous regions. IBPGR, together with FAO, has already taken a leading role in analysing the feasibility of international storage of duplicate collections under permafrost conditions. There is evidence of considerable interest among the developing countries in this general type of alternative.

2.4. Towards a Global Strategy

There are only few authoritative or generally-agreed opinions on any of the issues outlined in Sections 2.1, 2.2 and 2.3. Nonetheless, there

are many aspects of all of them that are researchable. Consensus-building will depend on greater understanding of the scientific, statistical, sociological, legal and political aspects that are involved. There are many elements of these issues on which the CGIAR must position itself to provide intellectual leadership as it moves to tackle, more explicitly, the second generation of problems stated in Section 1.2. Only when consensus has been reached will it be possible to move towards a more cost-effective global strategy for the conservation of plant genetic resources. Meanwhile, the CGIAR is continuing to invest a significant proportion of its total funding in this general area.

2.4.1. Future role of the CGIAR

The CGIAR has already made a substantial contribution to work on plant genetic resources through IBPGR and the Commodity Centres. One possible explanation for the System's sustained effort is the relative security of funding enjoyed by the CGIAR genebanks, compared with that of many national and regional genebanks. While some of the Centres have been criticised in the past for not giving their genebanks high priority, such deficiencies have now been largely rectified. As a consequence, the CGIAR genebanks constitute a major part of the total genebank capacity currently situated in the developing countries.

The germplasm (over 460,000 accessions) held by the CGIAR Centres is freely available to the developing countries they serve. If the CGIAR were to phase out its support for Centre genebanks, it is unlikely that the developing countries would be able to raise the financial resources required to maintain them. A more realistic expectation would be for national programmes to apply their limited resources to strengthen their activities in plant breeding and biotechnology, rather than invest substantial resources in the long-term preservation of large collections of germplasm, whether nationally or regionally. Consequently, the CGIAR will be unable, in the foreseeable future, to relinquish the responsibility it has accepted for maintaining the genebanks it has created. Such considerations give rise to a series of questions, many of which relate directly or indirectly to a clearer long-term definition of the respective roles of the IBPGR, the Commodity Centres, and the national programmes, in the total effort involved in the conservation and use of plant genetic resources.

2.4.2. Respective roles of IBPGR, Commodity Centres and national programmes

In its medium-term vision, TAC has proposed that there should be a clearer delineation of Centre responsibilities between global germplasm activities and regionally-defined agroecological, or "ecoregional" activities (TAC 1990). Global germplasm activities are predicted to evolve following the broad outline in Section 2.4.1. The details of the ecoregional activities are yet to be developed but are designed *inter alia* to remove some of the constraints that have traditionally limited Centres, in both their research and their relations with national programmes, to a strict interpretation of their commodity mandates.

The ecoregional model implies that Centres will be free to include in their collaborative programmes any crops, trees or livestock that are relevant to the problem identified, short of initiating their own programmes of genetic improvement on these species. The TAC document does not explicitly allude to the work on genetic resources in the context of ecoregional activities, but such work could implicitly be included in the conservation of natural resources.

The ecoregional approach implies close collaboration with national programmes, but also that the Centre will act as host for collaborating scientists from other Centres and organizations. No re-allocation of responsibilites to particular Centres has yet been made and TAC does not rule out the possibility that a limited number of Centres might be encouraged to assume both ecoregional as well as global germplasm responsibilities. Whatever the eventual distribution of responsibilities, however, there are new opportunities for active involvement of IBPGR. The alternative of excluding IBPGR from this restructuring would not fully capitalize on the evolving strengths of the Commodity Centres and the rationalization of collaboration with national programmes that could arise from the ecoregional concept.

IBPGR might develop its strategy to take advantage of these evolving opportunities. For example, IBPGR research staff could be outposted to Centres with global germplasm responsibilities for specific commodities, where they could fulfil their present functions, but also become part of an active research community. Centres with ecoregional responsibilities could be the focal point from which IBPGR regional staff could foster the development of crop networks, and other plant genetic resources activities for those crops that have not been part of the traditional mandates of the Commodity Centres.

Indeed, the Centres might consider going further and open the doors of their genebanks to base collections (or active collections) of germplasm for which developing countries require a "safe haven" and for which there is no politically acceptable accommodation elsewhere. Some might argue that such a move would overstretch the capacity of Centre genebanks. But this implies sorting out the issues of the composition and scale of collections. If Centres with ecoregional responsibilites could be the hub for crop networks in non-CGIAR crops, why not also participate in germplasm storage for these crops?

3. Inter-Centre Collaboration

TAC reaffirmed in the "CGIAR Policy on Plant Genetic Resources" the high priority accorded to the conservation of plant genetic resources. The CGIAR policy statement makes it clear that in addition to the responsibilities of IBPGR, the Commodity Centres "have responsibility for ensuring the establishment and maintenance of collections of material relevant to the improvemnet of their mandated crops". Furthermore, it states that they should "collaborate as an international network in promoting the exploration and collection necessary to fulfil this responsibility".

From the start, IBPGR interpreted its mandate in the broad sense, raising awareness and stimulating activities aimed at collecting and

preserving botanical and genetic diversity important to agriculture. It assumed a coordinating role among institutions, including those in developed countries. It could be argued that through the FAO, IBPGR and the Commodity Centres, the developing countries took the lead in making the conservation of genetic resources a global activity.

Considering the number of crops involved and the diversity of problem areas, it is obvious that the total resources currently deployed to meet the challenges are vastly inadequate. These considerations apply even more strongly if CGIAR also takes on the conservation of forest genetic resources and of multi-purpose trees. All such considerations present a major conceptual problem. How can CGIAR's resources be most efficiently applied and what is the most effective role that IBPGR and Commodity Centres can play?

3.1. Operational and Technical Issues

The CGIAR Commodity Centres store large collections of germplasm of several major crops. While the CGIAR charged them with a role in genetic conservation, the interpretation of this mandate was left largely to the management and boards of the individual Centres. Hence, there have been considerable differences in the approach and in the scale of the activities which were undertaken.

Until recently, different Commodity Centres cooperated with IBPGR in various ways and to varying degrees. Their strongest collaboration was in collecting, but appears to have been opportunistic rather than that based on long-term planning or on a coherent and collectively-agreed strategy for the System.

TAC recognized the need for closer collaboration among the CGIAR institutes, and suggested a list of operational and technical issues which should be considered (TAC 1988, see Appendix I). Consequently, the Inter-Centre Working Group was established. It comprises the representatives of the Commodity Centres and of IBPGR.

Before the formation of the Working Group, the Commodity Centres looked at IBPGR primarily as a funding agency. The Working Group fostered a dialogue among CGIAR institutes on a range of issues, and created a more constructive atmosphere for collaboration. The Inter-Centre Working Group at its second meeting in February 1989 at IRRI recommended a number of topics with the aim to increase inter-Centre collaboration (Appendix II).

Nevertheless, the Third External Review of IBPGR concluded that "the minutes of the three meetings held so far suggest a very cautious approach to cooperation. There is little evidence of agreements on joint activities or of specific commitments from the Commodity Centres on matters of common concern". Also, the operational and tecnical issues suggested by TAC in 1988 (Appendix I) have yet to be fully addressed by the Working Group.

The importance of germplasm collections to the breeding programmes of the Commodity Centres is obvious. Their programmes of collecting and evaluation have often been linked to specific breeding objectives. The Centres are understandably reluctant to dilute these programmes to meet, in their eyes, less specific aims of conservation. However, there are some

disadvantages associated with programmes that are too narrowly focused and conducted in ways that do not take account of more general needs. These disadvantages are associated with the following matters:

(i) The Commodity Centres, collectively, do not follow a common strategy in their approaches to plant genetic resources, which are often almost entirely based on their own requirements, rather than taking into account the broader needs for advancing the technology of conservation.

(ii) The conservation of wild species was, until recently, a relatively neglected area in Centre programmes. Centres have been more actively concerned with landraces and obsolescent varieties.

(iii) Centres collaborate with national programmes on a single-crop basis, whereas most countries have or need multi-crop genebanks. This causes confusion in methdology, documentation, assigning priorities and so on. IBPGR is expected to perform some coordination, but most Centres prefer to work through their own networks.

(iv) The Centres' main aim has been the improvement of germplasm, rather than its conservation. This resulted in a somewhat lower priority for conservation in their internal allocation of resources.

(v) Collectively, the Commodity Centres have not undertaken an explicit role in research of more general relevance to the conservation of plant genetic resources. No individual commodity programme appears to justify it and there is no established mechanism for determining priorities cutting across activities at several Centres.

(vi) Each Commodity Centre seem to have developed its own documentation system, independently with no attempt at standardization, and in some cases, without taking full advantage of modern information technology.

The Inter-Centre Working Group does not appear to have come to grips with any of these issues in ways that would lead to the collective formulation of an overall strategy by the Centres. The attitude emanating from discussions in the Working Group appears to be one of increased appreciation for the work of IBPGR as a mechanism for strengthening national programmes, leaving Commodity Centres to concentrate on their own crops for their own specific purposes.

3.2. Research

There is unquestionably a need for research that is relevant to the conservation of genetic resources (population genetics, taxonomy, ecology, seed physiology, etc.). However such research is at a disadvantage when competing for funds with research that yields more short-term economic benefits.

TAC concurs with the views of the Third IBPGR External Review that IBPGR should have a clearly-defined role in identifying and formulating research problems in plant genetic resources, and indicating ways of approaching them. This constitutes an essential, and often undervalued,

form of research. It is in this area that IBPGR is well placed to be the leading institution for identifying global needs for research on the conservation of plant genetic resources.

IBPGR should develop a clearer conceptual framework, within which criteria could be derived and priorities set. It should also develop criteria for selecting key problem areas to receive its own special attention and for identifying those that would be more appropriately tackled through crop networks and other mechanisms.

There is a need to rationalize both ex situ and in situ conservation of genetic resources. IBPGR should develop its research philosophy to meet this need. It should do so by assisting in the evolution of appropriate forms of cooperation, often on a crop-by-crop basis, and involving both national and international programmes. Research should be directed towards such central themes as improving documentation systems and developing basic technology and methodology for sampling genetic variation, both for the purpose of long-term conservation and for efficient use. In addition, research is needed to improve such aspects as conservation methodology and the safe transfer of genetic material.

There is broad consensus in TAC that IBPGR should not become directly involved in bench research. It should monitor and identify new problems by maintaining close contact with the genetic resources community, through its own regional offices, crop networks and other mechanisms. Its role should be to formulate researchable issues; to identify and bring together potential collaborators; and to facilitate the involvement of institutions both inside and outside the CGIAR System in undertaking the necessary research.

The extent to which IBPGR has so far been able to mobilize the research capability of the genetic resources community to undertake the necessary research bears little relation to the magnitude of the problems to be solved. Nonetheless, within the broad spectrum of the natural sciences, IBPGR has correctly identified the kinds of research necessary to rationalize and improve the scientific basis of the conservation of plant genetic resources. In these disciplines, the overall scope of the programme seems appropriate.

The following four possible courses of action have been suggested:

(i) IBPGR could initiate specific research projects designed to develop general methodology relevant to some of the common problems of the conservation of plant genetic resources. Adaptation of general principles to individual crops would then fall to individual genebanks or other national or international institutions.

(ii) IBPGR could use its core budget mainly to identify and formulate research required and fund, at most, some exploratory research to help in project formulation. In this model, a major function of IBPGR would be to find and stimulate other research organizations and donor agencies who would be willing to undertake and fund the work.

(iii) The CGIAR could accept a more explicit role in funding research on plant genetic resources and request IBPGR, in collaboration with the

Commodity Centres and national programmes, to formulate a Sytem-wide programme in areas of high priority. In this way an effective programme could be built up that would provide a stimulus to the whole subject and encourage other institutions to take up more specialized and crop-specific aspects.

(iv) IBPGR could seek substantially increased funding for the research component of its activities.

These strategies are by no means mutually exclusive. Elements of the first two are already implicit in IBPGR's strategic plannning. Both place heavy demands on a small organization, however, giving limited chances for rapid progress. Consequently, the third and fourth options outlined above could be considered.

Although Commodity Centres have been concerned only with their mandated crops and related species, they now represent a valuable reservoir of expertise, experience and facilities that is more widely relevant to problems of conservation. There are few better places where trainees from developing countries can obtain practical experience and where the senior staff are well-placed to give broad advice and assistance to the genetic resources units of national systems, extending beyond the crop species included in their own formal mandates. Moreover, Centres are in an increasingly stronger position to contribute to research on aspects of genetic resources, not only through their Genetic Resources Units but also through other relevant programmes, such as those in cytogenetics, plant protection and plant ecophysiology. There is a need to consider, therefore, how the Commodity Centres might become more involved in activities promoted by IBPGR within the context of the emerging medium-term and long-term visions proposed by TAC in its Expansion paper (TAC 1990).

4. Relationships Between the CGIAR and other International Efforts in the Conservation of Biodiversity

4.1. The International Genetic Resources Environment

In the 1980s, conservation of plant genetic resources evolved from an isolated issue to become merged with the growing global concern for the continued existence of the earth's biodiversity. The report of the World Commission on Environment and Development (WCED), better known as the Bruntland Report, signalled to the world community the need for sustainable development and conservation of natural resources. This message was widely accepted and provided further impetus to activities concerned with plant genetic resources at many levels and involving many organizations.

A seemingly unequal distribution of benefits between the South, harbouring most of the existing crop genetic diversity, and the North, collecting such material for use in plant breeding, led to political concerns about plant genetic resources. Some NGOs spearheaded the notion of plant genetic diversity as a national resource with long-term economic value for individual nations. In early 1980, debates on the subject were held at FAO. In 1983, as part of the FAO's effort to develop a global system on plant genetic resources, the FAO Commission on Plant Genetic Resources was established, and the International Undertaking on Plant

Genetic Resources was adopted. The establishment of the FAO Commission on Plant Genetic Resources provided an intergovernmental forum for debate and international collaboration. The intention of the International Undertaking on Plant genetic Resources is to safeguard free availability of genetic resources as a common resource to humankind. More recently, the beginning of a financial mechanism, the International Fund for Plant Genetic Resources, was added as a basic component of the global system.

The important role farmers play and have played in the development and conservation of landraces obtained expression in the concept of Farmers' Rights. This concept and the general concern over the role of farmers in development stimulated a number of NGOs to take an interest in genetic resources at local levels. Many national genebanks were established and national sovereignty over biodiversity became an issue. Meanwhile FAO, UNEP, WWF and IUCN stepped up activities, notably in attempts to develop a legal inter-governmental instrument to ensure the conservation of biodiversity. At the Fourth Session of the FAO Commission in April 1991, the notion that nations have sovereign rights over their plant genetic resources in their territories was accepted as a feature of the global system.

A new set of complicating issues is arising from developments in biotechnology and related intellectual property rights. These issues could threaten the principle of free availability of genetic resources. Therefore, in a relatively short time, the environment in which the CGIAR System has to operate has become extremely diverse and complex. One implication of the changed environment is that the CGIAR System may need to explicitly recognize the concept of national sovereignty, and be seen to be sensitive to national concerns.

In the past few years, IBPGR has made considerable progress in improving its relationships, notably with FAO. It has established contacts with various other international organizations, such as UNEP, IUCN and WWF. Much of the political confrontational attitudes of various groups has subsided, notably through the Keystone International Dialogue on Plant Genetic Resources. Representatives from a wide spectrum of interest groups in developed and developing countries have been involved in the dialogue in their personal capacities. IBPGR has formally participated in this dialogue.

4.2. Relationship with FAO

Collaboration with FAO, which has played an important role in the conservation of plant genetic resources, are among the most important of IBPGR's (and CGIAR's) 'external' relationships. In programmatic terms, the relationships between FAO and IBPGR have strengthened and there is substantial working contact between FAO and IBPGR.

FAO and IBPGR signed a Memorandum of Understanding (MOU) on Programme Cooperation in September 1990. This MOU, which is expected to remain in force after IBPGR's administrative independence, defines relative general responsibilities and principles and areas of cooperation. Although definite areas of overlap remain and may require futher discussion, IBPGR and FAO have come to a reasonable and mutually beneficial division of labour. The main responsibilities of FAO are:

(i) the political, legal and technical issues involved in the implementation of the principles and recommendations contained in the International Undertaking;

(ii) supporting and servicing the activities of the FAO Commission on Plant genetic Resources; and

(iii) assisting member countries in the development and implementation of activities related to the collecting, conservation and use of plant genetic resources.

The link between CGIAR and FAO on plant genetic resources is largely through IBPGR. Whether the MOU between IBPGR and FAO has a wider applicability to the CGIAR System as a whole is an issue which may be worth examining. Alternatively, each Centre may wish to consider signing a seperate MOU with FAO, particularly if Centres agree to bring their germplasm collections within the FAO network of base collections (see Section 5).

4.3. Relations with NGOs

A wide variety of NGOs have entered the field of plant genetic resources. Some are oriented towards political action; and some towards local action; some towards public education; and some towards influencing international organizations.

IBPGR's relations with the NGOs can be divided into two catagories. In the case of the more official and global organizations, including the IUCN and the WWF, relationships are very good. In this community, IBPGR is becoming recognized as a leading entity bringing expertise particularly on the ex situ conservation of germplasm. This is extremely valuable, and is consistent with the directions that the Third IBPGR External Review as a whole is suggesting for the Institute.

IBPGR has undertaken less effort to develop working relationships with the less official and the more local organizations. This is perhaps owing to the fact that these entities are often seen as political rather than scientific; political issues are, of course, the concern of FAO, rather than IBPGR. However, closer linkages with NGOs is likely to be an important issue in the new IBPGR strategy, and in recent months several significant steps have been taken by IBPGR to develop a stronger relationship with such NGO groups, where this is seen to be of mutual benefit.

4.4. The International Conservation of Biodiversity

The increased interest in the conservation of biodiversity as an environmental and ethical goal has been marked by growing political interest in habitat conservation in tropical forests such as those of the Amazon and of southeast Asia, by the emergence - all over the world - of informal farmer's networks seeking to conserve traditional varieties, and by the international evolution of programmes such as Unesco's Action Plan for Biospheric Reserves. The trend presents both risks to the free flow of genetic material and benefits to its conservation.

The risk derives from specific provisions of certain proposed international arrangements. One of the most important international negotiating goals is an international convention on the conservation of biological diversity, proposed for signature at the United Nations Conference on Environment and Development (UNCED) to be held in Rio de Janeiro in June 1992. The IUCN has been working for a number of years on a draft proposal for such a convention (IUCN 1989), followed by a more formal inter-governmental approach by UNEP. Such a convention could incorporate provisions under which nations would commit themselves to conserve specific habitats and species. They would be assisted in this by an international fund.

Discussions towards such a convention have been proceeding in an ad hoc expert working group organized by the UNEP. During these discussions, the idea of the IUCN report have evolved somewhat towards a pattern in which the quid pro quo for access to genetic material takes the form of technology rather than of funding. The direction the discussion will evolve by 1992 and even whether or not there will be a convention cannot yet be predicted; it is clear, however, that these discussions might lead to a weakening of traditional concepts of free access.

At the same time, the global trend presents an opportunity for the CGIAR System, because it reflects an intensifying interest and awareness of genetic resources. This offers the potential of new sources of political support for genetic conservation and for the work of IBPGR and the Commodity Centres, and thus the potential of broader support for the continued economic costs of genetic conservation.

5. Ownership and Security of CGIAR Funded Genebanks

The germplasm material held by the CGIAR Centres are collections created through international collaboration. According to the CGIAR policy statement, "Collections assembled as a result of international collaboration should not become the property of any single nation, but should be held in trust for the use of present and future generations of research workers in all countries throughout the world".

However, the ownership of genebanks held by the CGIAR Centres is partly conditioned by their agreements with their host countries. These differ considerably among Centres and are summarized in Appendix III. TAC considers that this issue should be given high priority by Centre Boards. Where necessary, Boards should seek to revise their agreements with their host countries to ensure that, in the event of the Centre ceasing to operate, the provisions made for the future of germplasm collections are consistent with the CGIAR policy. In general, provision should be made for samples of all accessions to be transferred to an alternative genebank, if conditions arise that prevent the Centre from continuing its operations. IBPGR is currently in the process of updating the information in Appendix III. At the same time IBPGR has contacted CGIAR Centres to investigate whether they would agree to bring their collections under the legal umbrella of FAO.

An additional element of germplasm security is to ensure that any given collection be duplicated at another institute. This provides insurance not only against loss, but also against the temporary

unavailability of material. Institutes that agree to accept responsibility for maintaining a base collection also undertake to make arrangements for the duplication of their collections. The CGIAR Policy on Plant Genetic Resources states that "As an insurance against hazards, the CGIAR supports the principle of replication in the storage of germplasm. For base collections, the aim is to establish duplicate sets in different countries. For active collections, there are advantages in replicating subsets of them wherever it would be useful and cost-effective to do so. The CGIAR institutions work collaboratively with national systems in pursuing these aims".

The state of duplication of the major holdings of CGIAR Centres, from the information provided by the Centres, was summarized by the Inter-Centre Working Group at its third meeting (see Appendix IV). Although it was difficult to determine accurately the status of duplication due principaly to the various ways "duplication" had been defined, it was clear that the level of duplication of many of these collections was surprisingly low. It varied between Centres, and between the different crops in each Centre. Only in few cases did it appear that an entire holding had been duplicated. However, the Inter-Centre Working Group concluded that the maintenance conditions for much of the CGIAR collections were generally satisfactory, with the samples mostly being kept under long-term storage conditions in purpose-built facilities. IBPGR is currently collating the information required to clarify the issue of accuracy with new figures from each of the Centres.

The development of databases of genebank holdings, most probably as part of crop-specific networks, offers one possible way of tackling this problem which would enable redundant duplication to be reduced to a minimum. However, such an approach would inevitably take a long time and would require sustained commitment from all involved parties.

Most of the crop germplasm held by the Centres is conserved as seed, except for cassava, sweet potato, yam, forages and banana, for which some germplasm at least must be conserved in vegetative form in field genebanks and/or *in vitro*. In these cases, quite different considerations apply to duplication. Once technologies such as cryopreservation have been developed sufficiently for base conservation of vegetative material to be routine, it should be possible to apply similar procedures to the safe duplication of vegetative materials as now apply to orthodox seeds.

6. Conclusions

Consensus is required on key policy and strategic issues that would foster a coherent and cost-effective evolution of the CGIAR programme on plant genetic resources. The agreement would need to take into account TAC's medium-term and long-term visions for the CGIAR System as well as the second generation problems such as the financial non-viability of many of the national programmes, and the policy implications of intellectual property rights elaboration in the TAC document AGR/TAC:IAR/91/17. In particular, there is a need to recognize the importance of regarding work on plant genetic resources as an integral part of crop improvement, and that activities associated with the conservation of genetic resources are more closely integrated into national and international genetic enhancement and breeding programmes. This would help to improve the cost-effectiveness

and long-term viability of national and regional programmes in plant genetic resources. In this regard, criteria and techniques are urgently needed to rationalize the size and form of germplasm collections to be conserved.

For the CGIAR System to provide effective leadership in the conservation of plant genetic resources, the strategies (and perhaps the mandates) of the individual Centre programmes might have to be reexamined, and there would have to be a strong integrating mechanism for collective action. A well-coordinated programme across the whole CGIAR System would provide a nucleus of activities that could stimulate research and conservation activities in national programmes and in the work of other institutions.

The CGIAR should widen the scope of its scientific and technical support for the conservation of germplasm by using the capability of all its institutions with relevant mandates to assist in solving problems that are common to a range of species. However, inter-Centre collaboration on research and other aspects of plant genetic resources should be planned and undertaken within the framework of a System-wide programme strategy. IBPGR could provide leadership, and with the Commodity Centres, should draw up a strategy for collaboration for consideration by TAC and the CGIAR.

The Commodity Centres and IBPGR work in a rather complex and diversified environment, and the CGIAR System is now well aware that it does not act alone. In addition to collaborating with genebanks, the plant breeding community and research institutes involved in related research, the CGIAR System must also face the social and political issues concerned with biodiversity if it is to play a leading role in the conservation of plant genetic resources. Of special significance in this respect is UNCED in 1992 as a follow-up of the Bruntland Report where conservation of biodiversity will be one of the important themes. This political forum provides a major opportunity for obtaining additional support for plant genetic resources as part of global biodiversity conservation.

The issue of ownership and safe duplication of the germplasm collections held in trust by CGIAR Centrs needs to be given high priority. One possible way to tackle the issue would be to bring the CGIAR germplasm collections under the legal umbrella of FAO, and to promote the development of databases of genebank holdings as part of crop-specific networks.

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APPENDIX I

Issues for Consideration by the Inter-Centre Working Group

There is a continuing need for more effective collaboration among the major institutions involved in work on plant genetic resources. The CGIAR institutions have already done much to foster collaboration on a world scale through cooperative programmes and international networks. TAC sees the creation of an inter-Centre working group as an important means of fostering closer collaboration among the CGIAR institutions as well as between the CGIAR institutions and those outside the System.

Of the issues already identified, TAC considers that a number could profitably be discussed by the inter-Centre working group and recommendations made accordingly. The issues listed below are in their approximate order of priority:

(i) The establishment of formal mechanisms within the CGIAR System for assembling information, reviewing responsibilities, improving communication and identifying further issues on all matters relating to the conservation of plant genetic resources.

(ii) The dissemination of information and the promotion of public awareness on matters related to the conservation of plant genetic resources.

(iii) The development of inter-Centre mechanisms for joint inter-Centre collaboration in working with national systems in the collection, evaluation and storage of germplasm, as well as in training.

(iv) The feasibility of establishing computer networks for data gathering and interchange.

(v) The definition of specific problems in research; review of the capacity of the System to undertake research and how its research capacity might best be exploited.

(vi) Problems of plant health and quarantine in relation to efficiency in the interchange of germplasm.

(vii) The importance of wild species and primitive forms (relative to other accessions) in work on genetic resources by the commodity Centres.

TOPICS IDENTIFIED FOR INTER-CENTRE COLLABORATION BY THE 1989 MEETING OF THE INTER-CENTRE WORKING GROUP ON PLANT GENETIC RESOURCES

Inter-Centre Collaboration on:		Recommended Action
COLLECTING	Coordination of activities of CG Centres	Centres to communicate plans at an early stage to allow coordination of action
		IBPGR to develop and implement crop network concept
		Inter-Centre missions and IBPGR participation in planning missions
		Collector's manual to be prepared by IBPGR in conjunction with CG Centres
	Follow-up on past collecting work	Examine possibility of establishing database on all past missions
WILD SPECIES	Importance of work by CG Centres on wild species	Continued emphasis on collecting and *ex situ* conservation
		Increased attention to utilization and research to encourage use of material by plant breeders
		Increased funding sought for work on wild species
	Maintaining wild species *in situ*	Preferable to *ex situ* but beyond scope of IARCs
	Increasing understanding of importance of wild species	CGIAR booklet on past utilization as wild species (and their usefulness) – special project funding to be sought
TRAINING	Continuing need for effective training	Continued pooling of training materials and expertise
		Multilingual training materials
		IBPGR to maintain a central database of courses and trainees
		More practical training in areas such as database management
DOCUMENTATION	Total coverage of all existing collections	Compile information on all existing collections in collaboration with NARS
		CG Centres to work to develop global databases for their crops
	Easy availability of global databases through technology	IBPGR to identify minimum standard set of equipment to handle crop databases
		Proposal to be prepared to obtain donor funds for equipment for key NARS genebanks
		Improved bibliographic services
STRATEGIC RESEARCH	Topics for collaboration on bottleneck problems	Non-destructive viability testing
		Cryopreservation
		Diversity studies and distribution mapping
		Core collections for duplicate storage
		Factors underlying genetic variation under traditional farming systems
		Stability of seeds in long-term storage
		Characterization to enhance efficient evaluation
		Genetic and cytogenetic studies of newly observed variants
		Genetic erosion during conservation
		Germplasm regeneration
DUPLICATE STORAGE OF BASE AND ACTIVE COLLECTIONS	Need for duplication of base and active collections	Centres working on same crops should ensure duplicate storage
		Produce subsets or core collections to facilitate wide duplication
		Use of permafrost storage in Norway to be pursued

GERMPLASM EXCHANGE	*Availability and supply of germplasm*	*Continued support for CGIAR policy on supply* Mechanisms such as MOUs with governments to promote exchange
SEED HEALTH	*Phytosanitary standards*	CG Centres will adhere strictly to any national legislation CG Centres will use their expertise for additional testing and certification of germplasm for safe exchange
PUBLICATION AND PUBLIC AWARENESS		Support to CGIAR initiative in public awareness, especially Latin American campaign IBPGR publishes for CGIAR 'Partners in Conservation' covering genetic resources activities of all CG Centres
GERMPLASM EVALUATION	Promoting evaluation and enhancement	CG Centres should play a more active and expanded role in evaluation and enhancement especially of wild species Expand research to stimulate germplasm evaluation and enhancement
RELATIONSHIP WITH FAO COMMISSION ON PLANT GENETIC RESOURCES	Promotion of a positive working relationship	Commission could assist in • development of sites for duplication • conservation of germplasm not covered by CG Centres • legal aspects of *in situ* conservation
COLLABORATION OF CG CENTRE WITH NARS	National Programme development	Increase awareness of importance of plant genetic resources within countries Collaborative planning through crop networks Strengthen NARS in technical aspects and training Help NARS in seeking funds Share responsibilities for germplasm preservation
	CG Centre commitment to national interests	Promote in-country conservation by ensuring duplicate accessions are retained in the country of origin Improve rapport through, e.g. evaluation, publishing collaborative findings, organizing workshops CG Centres to consider providing annual statements of holdings status to NARS

APPENDIX III

AGREEMENTS BETWEEN CGIAR COMMODITY CENTRES AND THEIR HOST COUNTRIES AFFECTING THE LONG-TERM SECURITY OF THEIR GERMPLASM COLLECTIONS

CIAT — A recent agreement (to be ratified) between CIAT and Colombia allows CIAT the right to export seed without restriction. This right is extended for one year after either party notifies the other of its intention to terminate the existence of the Institute.

CIMMYT — The existing CIMMYT agreement states that in case of termination, its assets shall become a part of the National Center for Agricultural Education, Research and Extension Plan Chapingo. A proposed revised set of statutes states "in case of dissolution, the assets of CIMMYT INT situated in the host or other collaborating countries shall be retained by such countries and used for similar purposes or distributed to institutions having purposes similar to those of CIMMYT INT in the respective countries after agreement between the governments of those countries and the Board in consultation with members of the CGIAR."

CIP — CIP is developing an inter-genebank cooperation system to conserve genetic resources of mandated crops. Complete duplicate copies should be deposited in genebanks in two continents.

ICARDA — In the ICARDA agreement there is no specific reference to the genebank. The basic host-country agreement states that, in the event of dissolution, the assets of the Centre shall be retained by the host country.

ICRISAT — The ICRISAT constitution states that, in the event of dissolution, the disposition of all assets, except any land within India and fixed capital improvement thereon, shall be determined by the CGIAR after receiving recommendations from the Governing Board of ICRISAT.

IITA — In the event of its closure, IITA will move its germplasm collections to safe storage at a place determined by the CGIAR, and will leave duplicates of them with Nigerian authorities if asked to do so.

ILCA — All unique genetic resources held by ILCA are duplicated outside Africa, at Kew. ILCA has an agreement with the Ethiopian Government for the unrestricted movement of germplasm, in or out of the country, as required. There is a proposed agreement with the Plant Genetic Resources Centre (Ethiopia) to duplicate all original Ethiopian material in ILCA's long-term store.

IRRI The IRRI agreement states that no part of the assets and property of the Institute shall inure to the benefit of or be distributable to its members and that, if the existence of the Institute is terminated for any reason, all its physical plant, equipment and other assets shall become the property of the University of the Philippines. IRRI will explore the host country's concurrence to send out a duplicate set of the entire rice collection to appropriate sites for storage in the event of dissolution of the Institute.

WARDA If WARDA were to wind up its activities, arrangements would be made by WARDA to relocate its germplasm collection in suitable centres within and outside the region. This agreement has been established with all WARDA member states, including the host country.

APPENDIX IV

DUPLICATION STATUS OF THE IARC's GERMPLASM COLLECTIONS

RC	CROP/SPECIES	No.Acc.	DUPLICATES IN:	% Max/Min
AT	*Phaseolus*	26330	Brasil 7%; Costa Rica 31%; USDA, Pullman, USA; PBI,UK; others	78/67
	Tropical forages	20496	ILCA,Ethiopia; CSIRO,Australia; CENARGEN, Brazil. In the case of germplasm collected on joint CIAT-ILCA collecting missions, it is not clarified which is designated the duplicate collection.	28/20
	Manihot(wild and cultivated)	5413	Paraguay 3.2%; Peru 4.6%	7.8/4.6
MMYT	*Zea*	10707	NSSL,USA 51%; Mexico 26%; USA 43%;	100/51
	Triticum	61773	To be entirely dupl. at NSSL,USA	
	Hordeum	6503	This is, for breeding purposes, a subset of the ICARDA's collection	100/100
P	*Ipomoea batatas*	2867	IIDEA,Venezuela 32%; Peru 57%	89/57
	Ipomoea (wild)	574	No information on duplication	
	Solanum(cult.)	3477	Peru 72%; NSSL,USA 75%; INIAP, Ecuador 100%	100/100
	Solanum(wild)	907	RPIS, Sturgeon Bay,USA 12%	12/12
ARDA	*Aegilops* spp.	1015	GRU,Damascus,Syria 17%; Jordan 15%; Bari,Italy 7.5%; PARC, Pakistan 5%; Portugal 10%; USDA,USA 43%	100/43
	Cicer arietinum	7232	INIA,Spain 2.6%; Iran 10%; PIC, Turkey 1%; ICRISAT,India 40%; INIA, Chile 2.8%; Univ.of Jordan 1%; PARC, Pakistan 2.6%; ARARI,Turkey 1.5%; USDA,USA 5%; RPI, India 2%	68/40
	Hordeum spontaneum	1229	USDA,USA 94%; Bari,Italy 3.5%	97/94
	Hordeum vulgare	16124	USDA,USA 75.5%; Bari,Italy 3%; Univ.of Munich, FRG 1%; INRA, Morocco 2.3%; PARK, Pakistan 1%	82/75
	Lathyrus spp.	1321	GRU,Damascus,Syria 28%; South Univ.UK 53%; ZIGuk, DDR 15%; SADAF,Australia, 6%; Turkey 3%; ARI,Cyprus 2%; PARC, Pakistan 2%; USDA,USA 2%; others 5%	100/53
	Lens culinaris	6966	WRPIS,USA 8%; PIC, Turkey 1%; USAID,India 20%; Univ.Jordan 3.5%; INIA,Chile 1%; INIA,Spain 1.3%; PARC, Pakistan 2%; ICRISAT,India 0.5%; PORS,India 1%	36/20
	Medicago spp.	5120	GRU,Damascus,Syria 3.6%; SADAF,Australia 45%; INRA,Morocco 4.3%; Turkey 4%; Jordan 3%; Kew,UK 3%; WADA, Australia 11%; Iran 3%; Univ.Mosul,Iraq 1.3%; ALAD,Lebanon 6%; ILCA, Ethiopia 1%; NCARTT,Jordan 3%; others 1.3%	90/45
	Pisum spp.	3344	GRU,Damascus,Syria 1.6% John Innes,UK 32%; Bari,Italy 58%; South.Univ.,UK-2.5%; ALAD, Lebanon 1%; others 5.6%	100/59
	Triticum aestivum	6173	USAD,USA 22%; INRA,Morocco 6%; PARK,Pakistan 12%; Bari,Italy 34.5% others 2.3%	77/35
	Triticum durum	18033	Bari,Italy 68.5%; USDA,USA 20%	89/69
	Triticum turgidum var. *dicoccoides*	916	GRU,Damascus,Syria 1%; Bari, Italy 9%; Univ.Saskatson,Canada 88%; Kyoto,Japan 0.5%; USDA, USA 89%	100/89

continued

IARC	CROP/SPECIES	No.Acc.	DUPLICATES IN:	% Max/Min
	Vicia faba	3645	PIC,Turkey 1.5%; ARCG, Turkey, 2%; UMAN, Canada 4.3%; PBI, UK 3%; USAID, Ethiopia 7%; UHOH, FRG 6%; ARI, Cyprus 3%; INIA, Spain 5%; CIAT 1.5%	33/7
	Vicia spp.	4140	GRU, Damascus, Syria 15%; ZIGuk, DDR 11%; Bari, Italy 42%; SADAF, Australia 3%; RCA, Hungary 2%; Turkey 1.6%; ARI, Cyprus 2%; Turkey 1.6%; ARI, Cyprus 2%; Kew, UK 2%; South.Univ., UK 27%; Kajanda Univ. Japan 1%; NCARTT, Jordan 1%; others 2%	100/42
ICRISAT	*Arachis hypogaea*	12712	Junagadh, India: NSSL and Texas A&M, USA	50/50
	Cajanus cajan	11482	NBPGR and ICAR, India (agreement completed)	
	Cicer arietinum	15995	ICAR, India; ICARDA, Syria	30/30
	Eleusine coracana	2848	Bangalore, India; SADCC, Zimbabwe	50/50
	Minor millets	3762	Bangalore and NBPGR, India	80/80
	Pennisetum glaucum	21772	NBPGR, India; SADCC, Zimbabwe	24/24
	Sorghum	31817	PGRC/E, Ethiopia; NBPGR, India; NSSL,USA;	65/65
IITA	*Dioscorea*	2000	Univ.Abidjan,Côte d'Ivoire 15%	15/15
	Glycine	1500	INTSOY,USA 25%; AVRDC,Taiwan 18%	53/25
	Ipomoea	1500	CIP;Peru 67%; Nat.Root Crops, Nigeria 15%; Root & Tuber Research Project, Cameroon 36%	100/70
	Manihot	2000	Not duplicated	
	Musa	365	INIBAP,KUL,Leuven, Belgium 90%	90/90
	Oryza	12500	IRRI 24%; JNSL,Japan 27%	-/39
	Vigna (wild)	1531	Gembloux, Belgium 17%	17/17
	Vigna subterranea	2000	To be duplicated in Germany by the end of 1990	60/60
	Vigna unguiculata	15200	Bari,Italy 2% ;NSSL,USA; USDA Georgia,USA; Univ.California, Riverside, USA 30%	32/30
	Zea	1200	No information	
ILCA	Forage grasses	1775	[CSIRO,Australia; CIAT,	90/90
	Forage legumes	6759	Columbia;Belize;Kew,UK;	
	Browse plants	1466	Florida, USA; Zimbabwe 90%] From the 10000 total acc., 3000 is original germplasm and is duplicated in Kew, UK and CIAT, Colombia 35%. In the case of germplasm collected on joint CIAT-ILCA collecting missions, it is not clarified which is designated the duplicate collection.	
IRRI	*Oryza glaberrima*	2412	IITA 15%	15/15
	Oryza sativa	81500	USA 50%; other Asian NARS about 50%	100/50
	Oryza (wild)	2490	Japan 25%	25/25
WARDA	*Oryza* (wild and cultivated)	5400	IRRI 11.4%; IITA 18.3%	30/18